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ARE WE THERE YET?

Roadside bombs in Iraq and Afghanistan have forced the Pentagon to significantly redesign its ground vehicles to provide better protection. Now, the Defense Advanced Research Projects Agency (Darpa) has a radical way for making sure ground vehicles avoid the deadly threat of improvised explosive devices (IEDs): just have them fly over the bombs.

That's the vision behind a new Darpa program called Transformer—TX for short—aimed at building a vehicle that drives like a car and flies like an airplane. The goal, according to agency officials, is to allow the vehicle to traverse rough terrain and then fly to avoid routes known for being at high risk for ambush and IEDs.

"There's no shortage of flying car concepts," Stephen Waller, TX program manager, told an audience at a recent industry workshop sponsored by Darpa to discuss the project.

TERRAFUGIA

Terrafugia's flying car is one of dozens proposed by industry over the years.

That could well be the understatement of the decade. According to roadabletimes.com, which tracks flying cars, there have been about 100 concepts dating back to the beginning of the 20th century.

The history of flying cars is filled with hucksters, dreamers and engineers. Terrafugia of Woburn, Mass., is already selling a car with fold-up wings for $194,000—it will be available next year, according to the company's web site. Skycar, a vertical-takeoff-and-landing (VTOL) aircraft offered by Moller International of Davis, Calif., has been in the works for decades, but has never flown. (Moller ended up paying a fine to the U.S. Securities and Exchange Commission concerning sales of its stock.)

Bell Helicopter has also looked at the flying car market, partnering with Israeli firm Urban Aeronautics on the X-Hawk, a ducted-fan vehicle designed to operate in urban areas. (For a report on an unmanned aerial vehicle that's being developed by Urban Aeronautics to evacuate casualties from a battlefield, see *DTI* March, p. 16.)

Darpa, however, is determined to learn from past prototypes and take advantage of advances in propulsion and materials. Even so, getting the right mix of car and plane will be a challenge and Darpa's wish list runs long: A flying car must be driven like a Humvee while on the ground, rapidly reconfigure for flight, then change back for ground operations. It also must be capable of VTOL, and reach the flying speed of a light aircraft—faster than 120 mph. "If you're slower than that, it might be better to drive," said Waller.

A key distinguishing feature of this project is that it must be manned and capable of carrying four passengers. "It's not Darpa Grand Challenge," said Waller, referring to Darpa's robotic car races in the desert.

Contenders for the flying car will have to deal with a host of technological challenges, such as coming up with adaptive aerostructures and designing a propulsion system that meets Darpa's requirements. While Darpa is interested in electric propulsion and ducted fan configurations, it will consider other approaches, including direct fuel drive and dedicated lift engines. The vehicle must, however, run on military-grade fuel.

Even rotorcraft are not completely out of the question. Darpa said it would, for example, consider a modified version of Northrop Grumman's Fire Scout VTOL tactical unmanned aerial vehicle. But it must have a small, shrouded rotor and meet Darpa's requirements for ruggedness and cargo.

Technology could help the flying car escape from its Rube Goldberg past. Urban Aeronautics and others have shown that fly-by-wire makes ducted-fan vehicles nimble and controllable. Small turbine engines are powerful and cheap, and electrical activators make shape-shifting vehicles more practical.

The ultimate question is, if Darpa is successful in building the aircraft, would one of the military services agree to buy it? So far, Darpa's only military support is from the U.S. Marine Corps, which looks at the flying car as potentially useful for medical evacuation, inserting troops and resupply, among other missions. Marine Lt. Col. Ed Tovar, who is working on the Darpa project, told the industry audience that the Air Force wasn't interested because TX doesn't fly high and fast, the Army was concerned that it would compete with helicopters, and it just wasn't "cool enough" for the Navy.

"But I liked it," said Tovar. "It resonated with me."

Whether Darpa can take the idea from PowerPoint slides to test flight is yet to be seen. Darpa's schedule for Transformer is ambitious—it wants to fly a prototype within four years. But even if Darpa is able to overcome the technical challenges, it will still have to face the concerns of infantry troops who could be skeptical of a strange-looking flying car.

"If you're fortunate and you get some money and we build something and it looks really funky," Waller told the audience, "be prepared to go with me to Quantico (Va.) when we deliver it." ■

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